15.2.3.4.1 IEEE Standard 743-1984, IEEE Standard Methods and Equipment for Measuring Transmission Characteristics of Analog Voice Frequency Circuits.

15.2.3.4.2 ANSI/IEEE Standard 820-1984, Telephone Loop Performance Characteristics.

15.2.4 **Services and Capabilities**

15.2.4.1 All Network Elements shall provide performance sufficient, in combination with other Network Elements, to provide the following applications in accordance with the requirements of this document:

15.2.4.1.1 All types of voice services.

15.2.4.1.2 All types of voice-band data modem connections up to and including 28.8 Kbps V-34.

15.2.4.1.3 All types of FAX transmissions up to and including 14.4 Kbps group 3.

15.2.4.1.4 All CLASS/LASS features.

15.2.4.1.5 All Operator Systems.

15.2.4.2 The following capabilities shall be provided as applicable:

15.2.4.2.1 ISDN BRI

15.2.4.2.2 ISDN PRI

15.2.4.2.3 Switched Digital Data

15.2.4.2.4 Non-Switched Digital Data

15.2.4.2.5 Any types of Video applications that a customer may order

15.2.4.2.6 Any Coin Services the customer may order

15.2.4.2.7 Frame Relay and ATM

15.2.4.2.8 Private Line Services

15.2.5 Specific Performance Requirements for Network Elements and Ancillary Functions

15.2.5.1 The following sections itemize performance parameters for Network Elements and Ancillary Functions. ILEC shall provide performance equal to or better than all of the requirements set forth in this Section. Unless noted otherwise, requirements and objectives are given in terms of specific limits. This means that all tests (acceptance and ongoing performance) shall meet the limit(s) to satisfy the requirement.

15.2.5.2 **Performance Allocation**

15.2.5.2.1 Transmission path impairments may be classified as either analog or digital, and will depend on the nature of the signal transmitted across the Network Element. Analog impairments are introduced on any analog portion of the loop, typically between the NID portion of Loop Distribution and the analog to digital (A/D) conversion, and are usually correlated with the length of the physical plant. Digital impairments are introduced by A/D conversion and by interfaces between digital Network Elements. In addition, noise can be introduced by either analog transmission or the A/D conversion.

15.2.5.3 **Loop Combination Architecture Constraints**

15.2.5.3.1 The following constraints will limit not only the variety of Loop Combination architectures that may be considered, but also the architectures ILEC may consider to deliver any Ancillary Function or Network Element. These constraints apply to the entire path between the NID portion of Loop Distribution and the ILEC switch. Any exceptions to these restrictions shall be specifically requested or approved by MCIm in writing.

15.2.5.3.1.1 No more than 1 A-D conversion.

15.2.5.3.1.2 No more than 1, 2-to-4-wire hybrid.

15.2.5.3.1.3 No voice compression.

15.2.5.3.1.4 No echo canceled or suppressers.

15.2.5.3.1.5 One digital loss pad per PBX.

15.2.5.3.1.6 No digital gain.

15.2.5.3.1.7 No additional equipment that might significantly increase intermodulation distortion.

15.2.5.4 Transmission Impairments

15.2.5.4.1 Analog Impairments

15.2.5.4.1.1 Analog impairments are those introduced on portions of the end-to-end circuit on which communications signals are transmitted in analog format. These portions of the transmission path would typically be between NID and an A/D conversion, most commonly on the metallic loop. The performance on the analog portion of a circuit is typically inversely proportional to the length of that circuit.

15.2.5.4.1.2 **Loss**

15.2.5.4.1.2.1 Electrical loss is measured using a 1004 Hz 0.0 DB one Milliwatt 900 ohm test tone.

15.2.5.4.1.2.2 Off-hook electrical loss between the NID and the switch shall be no more than 8.0 dB for any line, and the mean value for all lines shall be 3.5 dB ±0.5 dB. On-hook electrical loss between the NID and the switch shall be no more than 4.0 dB above the off-hook electrical loss for any line.

15.2.5.4.1.3 **Idle Channel Circuit Noise**

15.2.5.4.1.3.1 Idle channel circuit noise (C-message) is added by analog facilities, by the A/D conversion of signals, by digital processing equipment (e.g., echo cancelers, digital loss pads), robbed bit signaling, and errors on digital facilities.

15.2.5.4.1.3.2 Idle channel circuit noise shall be less than or equal to 18 dBrnC.

15.2.5.4.1.4 **Talker Echo**

15.2.5.4.1.4.1 The primary source of echo is improper impedance-matching at the 2-to-4 wire hybrid in the ILEC network. The impact on customer perception is a function of both echo return loss and delay.

15.2.5.4.1.4.2 Echo Return Loss (ERL) shall be greater than 26 dB to a standard termination (900 ohms, 2.16 μFd), and greater than 14 dB to a telephone set off-hook. Singing Return Loss (SRL) shall be greater than 2l dB to a standard termination, and greater than 11 dB to a telephone set off-hook.

15.2.5.4.1.5 **Listener Echo**

Listener echo is a double reflection of a transmitted signal at two different impedance mismatches in the end-to-end connection. While in extreme cases it can degrade voice transmission performance, listener echo is primarily an issue for voiceband data. The requirements on Talker Echo shall apply to Listener Echo.

15.2.5.4.1.6 **Propagation and Processing Delay**

15.2.5.4.1.6.1 Propagation delay is the delay involved in transmitting information from one

location to another. It is caused by processing delays of equipment in the network and delays associated with traveling across transmission facilities.

15.2.5.4.1.6.2 ILEC shall cooperate with MCIm to limit total service propagation and processing delay to levels at parity with that within the ILEC local network.

15.2.5.4.1.7 **Signal-to-Noise Ratio**

15.2.5.4.1.7.1 The Signal-to-Noise Ratio (S/N) is a critical parameter in determining voiceband data performance. It is typically measured with a 1004 Hz tone.

15.2.5.4.1.7.2 ILEC must provide on the Loop Combination a signal-to-noise ratio of at least 37 dB between the NID and the end office.

15.2.5.4.1.8 **C-Notched Noise**

The requirements for Signal-to-Noise Ratio shall apply to C-Notched Noise.

15.2.5.4.1.9 **Attenuation Distortion**

15.2.5.4.1.9.1 Attenuation distortion, also known as frequency distortion or gain slope, measures the variations in loss at different frequencies across the voice frequency spectrum (200 Hz - 3400 Hz). It is measured by subtracting the loss at 1004 Hz from the loss at the frequency of interest.

15.2.5.4.1.9.2 Attenuation distortion from the NID to the switch shall be within the range ±0.5 dB for frequencies between 304 and 3004 Hz; from the switch to NID attenuation distortion shall be within the range ±0.5 dB for frequencies between 204 Hz and 3004 Hz. In addition, attenuation distortion shall remain

within the range +1 dB/-3 dB for frequencies between 200 Hz and 3500 Hz.

15.2.5.4.1.10 **Envelope Delay Distortion**

15.2.5.4.1.10.1 Envelope Delay Distortion (EDD) measures the difference in transit time of signals at different frequencies. EDD is measured relative to the transit time of a 1704 Hz tone, and is given in microseconds. EDD is used as an approximation of the group delay of the channel.

15.2.5.4.1.10.2 EDD shall be: 1704 Hz to 604 Hz — ≤ 350 μsec.; 1704 Hz to 2804 Hz — ≤ 195 μsec.; 1704 Hz to 204 Hz — ≤ 580 μsec.; 1704 Hz to 3404 Hz — ≤ 400 μsec.

15.2.5.4.1.11 **Phase Jitter**

15.2.5.4.1.11.1 Phase jitter measures the unwanted angular modulation of a signal. It is caused by noise of the actual modulation of the signal by another unwanted signal. It displaces the zero crossings of a signal. It is measured in terms of peak-to-peak deviations of a 1004 Hz tone from its nominal zero crossings, and in a particular frequency band (200-300 HZ and either 4-300 Hz or 2-300 Hz). Phase jitter impacts voiceband data performance and can make modems more susceptible to other impairments, including noise.

15.2.5.4.1.11.2 From the NID to the interexchange carrier point of termination, phase jitter shall be < 1.5° point-to-point in the 0-300 Hz band, and
< 1.8° point-to-point in the 4-300 Hz band.

15.2.5.4.1.12 **Amplitude Jitter**

15.2.5.4.1.12.1 Amplitude jitter is any deviation of the peak value of a 1004 Hz signal

from its nominal value. Excessive amounts can impair voiceband data performance. It is primarily caused by noise but can also be caused by phase jitter, gain hits, or single frequency interference.

15.2.5.4.1.12.2 In NID-interexchange carrier point of termination, ≤ 2.5% of amplitude jitter is permitted in the 20-300 Hz band and ≤ 2.9% in the 4-300 Hz band.

15.2.5.4.1.13 **Intermodulation Distortion**

15.2.5.4.1.13.1 Intermodulation distortion (IMD) measures non-linear distortions of a signal. It compares the power of harmonic tones to the power of the transmitted tones. It is measured for both the 2nd and 3rd harmonics of the transmitted tones. IMD is caused by compression or clipping and can impair voiceband data performance.

15.2.5.4.1.13.2 Both 2nd and 3rd order IMD between the NID and end office must be ≥ 52 dB.

15.2.5.4.1.14 **Impulse Noise**

15.2.5.4.1.14.1 Impulse noise is a sudden and large increase in noise on a channel for a short duration of time. Impulse noise is measured as a count of the number of times a noise threshold is exceeded during a given time period (typically 5 or 15 minutes). It is caused by protection switching, maintenance activities, electromechanical switching systems, digital transmission errors, and line coding mismatches. Impulse noise sounds like clicking noises or static on voice connections. Impulse noise impairs voiceband data performance.

15.2.5.4.1.14.2 The NID to interexchange carrier point of termination portions of connections shall introduce no impulse noise events within 6 dB of the received signal power

on 93% of all 15 minute connections. In addition, there shall be no more than 1 impulse noise event within 6 dB of the received signal power during any 30-minute period.

15.2.5.4.1.15 **Phase Hits**

15.2.5.4.1.15.1 Phase hits are a sudden change in the phase of a signal lasting at least 4 msec. Phase hits are measured using a threshold which indicates how much the phase of the signal has changed with respect to its nominal phase. Phase hits are caused by protection switching and slips or other synchronization errors. Phase hits can impair voiceband data performance.

15.2.5.4.1.15.2 Between the NID and interexchange carrier point of termination, 99.75% of all 15-minute connections shall have no phase hits exceeding 10°. In addition, there shall be no more than 1 phase hit exceeding 10° in any 30-minute period.

15.2.5.4.1.16 **Gain Hits**

15.2.5.4.1.16.1 Gain hits are sudden changes in the level of a signal that last at least 4 msec. Gain hits are measured against a threshold of typically 2-5 dB relative to the signal's nominal level. Gain hits are usually caused by protection switches and can impair voiceband data performance.

15.2.5.4.1.16.2 Between the NID and the interexchange carrier point of termination, 99.5% of all 15-minute connections shall have no gain hits exceeding 3 dB. In addition, there shall be no more than 1 gain hit exceeding 3 dB in any 30-minute period.

15.2.5.4.1.17 **Dropouts**

15.2.5.4.1.17.1 Dropouts are drops in the level of a signal of 12 dB or more for at least 4

msec. They are caused by protection switching events, radio fading, and conditions causing digital carrier systems to lose frame. Dropouts are critical for voiceband data performance but, if severe enough, will also affect voice quality.

15.2.5.4.1.17.2 Between the NID and the interexchange carrier point of termination, 99.9% of all 15-minute connections shall have no dropouts and in addition, no connection shall suffer more than 1 dropout in any 60-minute period.

15.2.5.4.1.18 **Frequency Shift**

15.2.5.4.1.18.1 Frequency shift measures any frequency changes that occur when a signal is transmitted across a channel. It is typically measured using a 1004 Hz tone. Frequency shift has very little impact on voice or voiceband data performance; however, round-trip frequency shifts can affect the ability of echo cancelers to remain converged.

15.2.5.4.1.18.2 No more than 0.2 Hz frequency shift shall be on any connection. In addition, 99.5% of all calls shall have frequency shift < 0.1 Hz.

15.2.5.4.1.19 **Crosstalk**

15.2.5.4.1.19.1 Crosstalk is the presence of signals from other telephone connections on a circuit. Crosstalk can be either intelligible, when speech from other connections can be heard and understood, or unintelligible. Crosstalk is caused by inter-channel interference on the transmission system. Crosstalk is difficult to measure: it requires correlating signals on different circuits or using human listeners to identify its presence. Trouble reports may be used to estimate the probability of crosstalk.

15.2.5.4.1.19.2 99% of Loop Combinations shall have probability ≤ 0.1% of experiencing crosstalk exceeding -65 dBm0.

15.2.5.4.1.20 **Clipping**

15.2.5.4.1.20.1 Clipping occurs when part of a transmitted signal is dropped and does not reach the receiving portion on a connection. It can be caused by Digital Speech Interpolation (DSI) equipment used in Digital Circuit Multiplication Systems (DCMS) which increase the amount of traffic that transmission facilities carry, and by echo cancelers or echo suppressers.

15.2.5.4.1.20.2 No clipping incidents shall occur on any call.

15.2.5.4.2 **Digital Impairments**

Digital impairments occur in the signal wherever it is transmitted in digital format. These errors are usually introduced upon conversion of the signal from analog to digital, as well as at interfaces between digital components. While many digital impairments have little impact on subjective voice quality, they can impact voiceband data performance.

15.2.5.4.2.1 **Signal Correlated Distortion**

15.2.5.4.2.1.1 Signal correlated distortion (SCD) is unwanted noise or distortion introduced into a signal through the conversion of a signal from analog to digital format or through digital processing that changes the transmitted signal. SCD affects performance when a sign is being transmitted. The primary sources of SCD are signal encoders, echo cancelers, digital loss pads, and robbed bit signaling. SCD affects both voice and voiceband data performance.

15.2.5.4.2.1.2 The NID-to-end-office connection shall allow:

15.2.5.4.2.1.2.1 A maximum of 1 A/D conversion, using 64 Kbps μ-law (μ=255) PCM;

15.2.5.4.2.1.2.2 No voice compression;

15.2.5.4.2.1.2.3 No echo cancellation; and

15.2.5.4.2.1.2.4 Robbed bit signaling only if SS7 or ISDN are not used.

15.2.5.4.2.2 **Slips**

15.2.5.4.2.2.1 Slips occur when a frame of digital data is either deleted or repeated because of differences in the clocks used to synchronize digital facilities. Slips sound like clicks or pops on voice calls and have major impact on voiceband data performance.

15.2.5.4.2.2.2 The NID-to-interexchange carrier point of termination portion of connections shall have fewer than 0.45 slips every 24 hours on average.

15.2.5.4.2.3 **Digital Timing Jitter and Wander**

15.2.5.4.2.3.1 Digital timing jitter is the unwanted phase modulation of digital signals at rates above 10 Hz. Wander is the unwanted phase modulation of digital signals at rates below 10 Hz. Digital timing jitter is caused by imperfections in the timing recovery process of repeaters and the stuffing synchronization process used by multiplexer/demultiplexers. Wander is caused by slowly varying changes in digital signal phase due to clock frequency offset and drift, changes in propagation delay of terrestrial facilities due to temperature changes and changes in the distance of

satellites from the earth. These events have a major impact on voiceband data performance.

15.2.5.4.2.3.2 The maximum digital timing jitter allowed in the 10 Hz to 8 kHz frequency band at any network interface or any terminal equipment in the network is 5 Unit Intervals (UI). The maximum digital timing jitter allowed in the 8 kHz to 40 kHz frequency band is 0.1 UI. The objective for wander is less than 28 UI at any network interface or terminal equipment.

15.2.5.4.2.4 **DS-1 Errored Seconds**

15.2.5.4.2.4.1 An Errored Second (ES) on a DS-1 facility is any second during which at least 1 bit is in error. The impact of an ES on performance depends on the number of errors that occur during a second. Typically, voice performance is not significantly impacted by ES but they can cause errors in voiceband data transmissions.

15.2.5.4.2.4.2 Each ILEC network shall have less than 20 ESs per 24 hour period.

15.2.5.4.2.5 **DS-1 Severely Errored Seconds**

15.2.5.4.2.5.1 A severely Errored Second (SES) is any second during which a DS-1 has an error rate exceeding 0.001. An SES can be caused by a loss of framing, a slip, or a protection switch. SESs have impacts on both voice and voiceband data performance. For voice, a SES will sound like a burst of noise or static. SESs that occur during a voiceband data transmission cause a significant burst of errors and can cause modems to retrain.

15.2.5.4.2.5.2 The digital portion of each NID to POP connection shall have less than 2 SESs per 24 hour period.

15.2.5.4.2.6 **Short Failure Events**

15.2.5.4.2.6.1 A Short Failure Event (SFE) is a Loss of Frame (LOF) event of less than two minutes' duration. An LOF event is declared when, on detection of a Loss of Signal (LOS) or Out-of-Frame (OOF), a rise-slope-type integration process starts that declares a LOF after 2.5±0.5 sec. of continuous LOS or OOF. If the LOS or OOF is intermittent the integration process shall decay at a slope of 1/5 the rise slope during the period when the signal is normal. Thus, if the ratio of a LOS or OOF to a normal signal is greater than 1/2, a LOF will be declared. A LOS condition shall be declared when the Network Channel Terminating Equipment has determined that 175±75 successive pulse positions with no pulses of either positive or negative polarity have occurred. An OOF condition shall be declared when either Network equipment or Digital Terminal Equipment detects errors in the framing pattern.

15.2.5.4.2.6.2 There shall be fewer than 1 SFE per month.

15.2.5.5 **Service Availability and Reliability**

Availability refers to the time period during which the service is up and usable for its intended purpose. Reliability refers to the probability that a task will be completed successfully, given that it is successfully begun.

15.2.5.5.1 **Blocked Calls**

15.2.5.5.1.1 Blocking is the fraction of call origination attempts denied service during a stated measurement period. Blocking occurs because of competition for limited resources within the network.

15.2.5.5.1.2 For intraLATA toll service and local exchange service, the blocking level from originating (NID) to terminating NID shall not exceed 1% in any hour, except under

conditions of service disruption. For access to or egress from a long distance network, the blocking rate shall not exceed 0.5% in any hour.

15.2.5.5.2 **Downtime**

Downtime is the period of time that a system is in a failed state.

15.2.5.5.2.1 The average downtime for all subscriber Loop Combinations shall be less than 49 minutes per year. The maximum downtime for 99% of all subscriber Loop Combinations shall be less than 74 minutes per year.

15.2.5.5.2.2 The average downtime for an end office switch shall be less than 3 minutes per year. The average downtime for individual trunks shall be less than 28 minutes per year. The average downtime for digital trunk groups shall be less than 20 minutes per year. The average downtime for an individual line appearance at the switch shall be less than 28 minutes per year. The average downtime for a Remote Terminal (RT) shall be less than 17 minutes per year. The average downtime for an individual line on a Remote Terminal (RT) shall be less than 13 minutes per year.

15.2.5.5.2.3 The mean time to repair (MTTR) of any equipment at an attended site shall be less than 3 hours. The mean time to repair (MTTR) of any equipment at an unattended site shall be less than 4 hours. 95% of all repairs to the network interface (NID) shall be completed within 24 hours.

15.2.5.5.2.4 There shall be no downtime due to power failures at the switch.

15.2.5.5.2.5 The probability of a stable call being cut off shall be less than 20 cutoffs per one million 1 minute calls.

15.2.5.5.2.6 The rate of ineffective machine attempts at the end office shall be less than 0.0005 (5 failures per 10,000 call attempts).

15.2.5.5.2.7 ILEC shall meet all requirements for private line services in TR-NWT-000335, ANSI T1.512-1994.

15.2.5.5.3 **Dial Tone Delay**

15.2.5.5.3.1 Dial-Tone Delay is the time period between a customer off-hook and the receipt of dial tone from an originating end office. Dial-Tone Delay has a significant effect on customer opinion of service quality.

15.2.5.5.3.2 The average dial-tone delay shall not exceed 1.5% of calls delayed more than 3 seconds. At most 20% of calls during the high day busy hour (HDBH) shall experience dial-tone delay greater than 3 seconds.

15.2.5.5.4 **Dial Tone Removal**

15.2.5.5.4.1 Dial tone removal is the time between recognition of the first address digit to the removal of dial tone on the line.

15.2.5.5.4.2 The maximum dial tone removal interval shall be ≤500 milliseconds.

15.2.5.5.5 **Post Dial Delay**

15.2.5.5.5.1 Post Dial Delay (PDD) is the amount of time a caller must wait after entering or dialing the last digit of a Destination Telephone Number (DTN) before hearing a valid audible network response. The PDD for an end user is measured from the time the caller has pressed or dialed the last digit of a DTN until receipt of an audible network response.

15.2.5.5.5.2 The requirements given reflect an end-to-end CCS7 protocol for MCIm end users. Where a

mixture of CCS7 and inband (MF) signaling protocols are employed, an increase in the PDD can be expected.

15.2.5.5.5.2.1 **PDD 1 - A - Intra LSO**

15.2.5.5.5.2.1.1 Intra-LSO calls do not employ external signaling protocols. The PDD for intra-LSO calls flows are dependent upon the processor cycle time and traffic load conditions. This PDD is assumed to be between customers on the same LSO, between the Remote Switch Modules (RSMs) on the same Host, or between an RSM and Host customers.

15.2.5.5.5.2.1.2 The objective for intra-LSO PDD is less than 310 milliseconds for 50% of all calls and less than 460 milliseconds for 95% of all calls.

15.2.5.5.5.2.2 **PDD1 - B - LSO to Another Local LSO**

15.2.5.5.5.2.2.1 The signaling protocols from an LSO to another LSO are assumed to employ out-of-band Common Channel Signaling System 7 (CCS7) format. Local calls, that is, calls from an LSO to another LSOs are assumed to have no more than one pair of Signaling Transfer Point Switches (STPs) and no more than one data base dip.

15.2.5.5.5.2.2.2 This PDD is expected to be better than the MCIT Long Distance objective with an average PDD of ≤ 8.70 seconds with 95% ≤1.34 seconds.

15.2.5.5.5.2.3 **PDD1 - C - MCIm LSO to Other LSO**

15.2.5.5.5.2.3.1 Calls from an MCIm LSO to other LSOs are dependent upon the interface agreements between MCIm and the LSO service provider and may employ CCS7, inband (MF) or a combination of both protocols.

15.2.5.5.5.2.3.2 Calls from an MCIm LSO to another LSO via the Public Switched Telecommunications

Network (PSTN), using end-to-end CCS7 signaling protocols, can expect to meet the MCIm PDD objectives of an average of 2.0 seconds with 95% in ≤2.5 seconds. Calls from an MCIm LSO via the PSTN to LSOs outside the local service area are assumed to use CCS7 signaling protocols to the MCIm switch. The egress signaling protocols from the MCIT Switched Network to the many different local telephone company service providers however does not necessarily utilize CCS7 signaling. There are three basic egress signaling configuration. They are:

15.2.5.5.5.2.3.2.1 Network Inter-Connect, CCS7 between MCIm and the local telephone company.

15.2.5.5.5.2.3.2.2 Inband Multifrequency (MF) signaling protocols without a ILEC egress tandem in the connection.

15.2.5.5.5.2.3.2.3 Inband MF signaling protocols with a ILEC egress tandem in the connection.

15.2.4.6.5.2.3.2.3.1 Calls from an MCIm LSO to other LSOs outside the local service area are assumed to have multiple STPs for 1+ traffic in the access and PSTN portion of the connection. The egress from the PSTN for 1+ traffic is again dependent upon the interface agreements in that service area and may consist of CCS7 or inband MF protocols.

15.2.4.6.5.2.3.2.3.2 Calls from an MCIm's LSO to another MCIm LSO with a mixture of CCS7 or all inband signaling protocols are expected to receive PDDs on the average of 2.9 seconds with 95% in ≤6.5 seconds.

15.2.5.5.5.2.4 **Impact of Number Portability (NP)**

If a call forwarding option is used as an interim solution for NP, the delay due to additional switching in the local access shall not exceed 0.4 seconds (95th percentile) in addition to the PDDs described above.

15.2.5.5.5.2.5 **Custom Local Area Subscriber Services (CLASS)**

CLASS[SM] features such as Calling Name Delivery can contribute to the PDD of a call. This delay is caused by the additional time (ILEC option) before the ringing interval commences. This default delay is 3 seconds. Optional settings are available in 1 second intervals from 1 to 6 seconds. Calls to DTNs that have CLASS[SM] features, particularly with calling name delivery, can expect to experience from 1 to 6 seconds (3 seconds default) of additional PDD compared to the PDDs shown for PDD1-C. MCI will specify optimal settings.

15.2.5.5.5.2.6 **Partial Dial Timing**

15.2.5.5.5.2.6.1 The interval between each information digit from a customer's line, until the LSO or switching system has determined that the digit string is incomplete.

15.2.5.5.5.2.6.2 For customer lines, partial dial timing shall be ≥16 seconds and ≤24 seconds. For trunks, inband signaling time-out shall be ≥5 seconds and ≤20 seconds.

15.2.5.6 **Local Switching**

ILEC shall provide performance equal to or better than the requirements for Local Switching set forth in Bellcore LSSGR TR-TSY-000511. Post dial delay for connections to MCIm local operator services shall be no worse than Operator Services provided by ILEC. Additionally, post dial delay from the Operator Services to destination numbers shall be no worse than that provided by ILEC. Post dial delay for connections to MCIm local directory services shall be no worse than directory services provided by ILEC. Additionally, post dial delay from the directory system to destination numbers shall be no worse than that provided by ILEC.

15.2.5.7 **Operator Systems**

Operator System connections shall comply with the requirements for the Loop Combination, Local Switching, Operator Service, and Directory Assistance Service requirements.

15.2.5.8 **Common Transport**

Specific requirements for this Network Element or Ancillary Function are in the Common Transport section. In all cases the performance of this Network Element shall meet the general requirements stated in "General Performance Requirements." Allocation of impairments shall be negotiated between MCIm and ILEC consistent with sound engineering principles.

15.2.5.9 **Dedicated Transport**

Specific requirements for this Network Element are in the Dedicated Transport section. In all cases the performance of this Network Element shall meet the general requirements stated in "General Performance Requirements." (Allocation of impairments shall be negotiated between MCIm and ILEC.) consistent with sound engineering principles.

15.2.5.10 **Signaling Transfer Points**

Specific requirements for this Network Element are in the Signaling Transfer Points section. In all cases the performance of this Network Element shall meet the general requirements stated in "General Performance Requirements." (Allocation of impairments shall be negotiated between MCIm and ILEC.)

15.2.5.11 **Signaling Link Transport**

Specific requirements for this Network Element are in the Signaling Link Transport section. In all cases the performance of this Network Element shall meet the general requirements stated in "General Performance Requirements." Allocation of impairments shall be negotiated between MCIm and ILEC consistent with sound engineering principles.

15.2.5.12 **SCPs/Databases**

The performance requirements for databases (NP, LIDB, E911, etc.) vary depending or the database and the applications it supports. Database-specific performance requirements are included in the sections addressing individual Network Elements and in applicable Bellcore documents. In all cases, the query response time, availability, accuracy, updating capabilities, and other performance parameters shall at least be at parity with those services as provided to ILEC or other customer.

15.2.5.13 **Tandem Switching**

Specific requirements for this Network Element are in the Tandem Switching section. In all cases the performance of this Network Element shall meet the general requirements stated in "General Performance Requirements." Allocation of impairments shall be negotiated between MCIm and ILEC consistent with sound engineering principles.

15.2.6 **Test and Verification**

15.2.6.1 ILEC shall permit MCIm to confirm acceptable performance of any Network Element.

15.2.6.1.1 At MCIm's request, ILEC will provide access to the Network Element sufficient for MCIm to test the performance of that Network Element to MCIm's satisfaction.

15.2.6.1.2 At MCIm's request, ILEC will perform tests to confirm acceptable performance and provide MCIm with documentation of test procedures and results acceptable to MCIm.

15.3 Protection, Restoration, and Disaster Recovery

15.3.1 **Scope:**

This Section refers specifically to requirements on the use of redundant network equipment and facilities for protection, restoration, and disaster recovery.

15.3.2 **Requirements**

15.3.2.1 ILEC shall provide protection, restoration, and disaster recovery capabilities at parity with those capabilities

provided for their own services, facilities and equipment (e.g., equivalent circuit pack protection ratios, facility protection ratios).

15.3.2.2 ILEC shall provide Network Elements and Ancillary Functions equal priority in protection, restoration, and disaster recovery as provided to their own services, facilities and equipment.

15.3.2.3 ILEC shall provide Network Elements and Ancillary Functions equal priority in the use of spare equipment and facilities as provided to their own services, facilities and equipment.

15.3.2.4 ILEC shall restore Network Elements which are specific to MCIm end user customers on a priority basis as MCIm may designate.

15.4 Synchronization

15.4.1 Definition:

Synchronization is the function which keeps all digital equipment in a communications network operating at the same average frequency. With respect to digital transmission, information is coded into discrete pulses. When these pulses are transmitted through a digital communications network, all synchronous Network Elements are traceable to a stable and accurate timing source. Network synchronization is accomplished by timing all synchronous Network Elements in the network to a stratum 1 source so that transmission from these network points have the same average line rate.

15.4.2 Technical Requirements

The following requirements are applicable to the case where ILEC provides synchronization to equipment that MCIm owns and operates within a ILEC location. In addition, these requirements apply to synchronous equipment that is owned by ILEC and is used to provide a Network Element to MCIm.

15.4.2.1 The synchronization of clocks within digital networks is divided into two parts: intra-building and inter-building. Within a building, a single clock is designated as

the Building Integrated Timing Supply (BITS), which provides all of the DS1 and DS0 synchronization references required by other clocks in such building. This is referred to as intra-building synchronization. The BITS receives synchronization references from remotely located BITS. Synchronization of BITS between buildings is referred to as inter-building synchronization.

15.4.2.2 To implement a network synchronization plan, clocks within digital networks are divided into four stratum levels. All clocks in strata 2, 3, and 4 are synchronized to a stratum 1 clock, that is, they are traceable to a stratum 1 clock. A traceable reference is a reference that can be traced back through some number of clocks to a stratum 1 source. Clocks in different strata are distinguished by their free running accuracy or by their stability during trouble conditions such as the loss of all synchronization references.

15.4.2.2.1 **Intra-Building**

15.4.2.2.1.1 Within a building, there may be different kinds of equipment that require synchronization at the DS1 and DS0 rates. Synchronization at the DS1 rate is accomplished by the frequency synchronizing presence of buffer stores at various DSI transmission interfaces. Synchronization at the DS0 rate is accomplished by using a composite clock signal that phase synchronizes the clocks. Equipment requiring DS0 synchronization frequently does not have adequate buffer storage to accommodate the phase variations among different equipment. Control of phase variations to an acceptable level is accomplished by externally timing all interconnecting DS0 circuits to a single clock source and by limiting the interconnection of DS0 equipment to less than 1,500 cable feet. Therefore, a BITS shall provide DS1 and composite clock signals when the appropriate composite signal is a 64-kHz $5/8^{th}$ duty cycle, return to zero with a bipolar violation every eighth pulse (B8RZ).

15.4.2.2.2 **Inter-Building**

15.4.2.2.2.1 ILEC shall provide inter-building synchronization at the DSI rate, and the BITS shall accept the primary and secondary synchronization links from BITS in other buildings. From hierarchical considerations, the BITS shall be the highest stratum clock within the building and ILEC shall provide operations capabilities (this includes, but is not limited to synchronization reference provisioning; synchronization reference status inquiries; timing mode status inquiries; and alarm conditions).

15.4.3 **Synchronization Distribution Requirements**

15.4.3.1 Central office BITS shall contain redundant clocks meeting or exceeding the requirements for a stratum 2 clock as specified in ANSI T1.101-1994 and Bellcore *TR-NWT-001244 Clocks for the Synchronized Network: Common Genetic Criteria.*

15.4.3.2 Central office BITS shall be powered by primary and backup power sources.

15.4.3.3 If both reference inputs to the BITS are interrupted or in a degraded mode (meaning off frequency greater than twice the minimum accuracy of the BITS, loss of frame, excessive bit errors, or in Alarm Indication Signal), then the stratum clock in the BITS shall provide the necessary bridge in timing to allow the network to operate without a frame repetition or deletion (slip free) with better performance than 1 frame repetition or deletion (slip) per week.

15.4.3.4 DS1s multiplexed into a SONET synchronous payload envelope within an STS-n (where n is defined in ANSI T1.105-1995) signal shall not be used as reference facilities for network synchronization.

15.4.3.5 The total number of Network Elements cascaded from the stratum 1 source shall be minimized.

15.4.3.6 A Network Element shall receive the synchronization reference signal only from another Network Element that contains a clock of equivalent or superior quality (stratum level).

15.4.3.7 ILEC shall select for synchronization those facilities shown to have the greatest degree of availability (absence of outages).

15.4.3.8 Where possible, all primary and secondary synchronization facilities shall be physically diverse (this means the maximum feasible physical separation of synchronization equipment and cabling).

15.4.3.9 No timing loops shall be formed in any combination of primary and secondary facilities.

15.4.3.10 An Operations Support System (OSS) shall continuously monitor the BITS for synchronization related failures or degradation.

15.4.3.11 An OSS shall continuously monitor all equipment transporting synchronization facilities for synchronization related failures or degradation.

15.4.3.12 For non-SONET equipment, ILEC shall provide synchronization facilities which, at a minimum, comply with the standards set forth in ANSI T1.101-1994.

15.4.3.13 For SONET equipment, ILEC shall provide synchronization facilities that have time deviation (TDEV) for integration times greater than 0.05 seconds and less than or equal to 10 seconds, that is less than or equal to 10 nanoseconds. TDEV, in nanoseconds, for integration times greater than 10 seconds and less than 1000 seconds, shall be less than 3.1623 times the square-root of the integration time. For example, for integration times of 25 seconds, TDEV shall be less than 15.8 nanoseconds.

15.5 SS7 Network Interconnection

15.5.1.1 **Definition**:

Figure 8 depicts Signaling System 7 (SS7) Network Interconnection. SS7 Network Interconnection is the interconnection of MCIm local Signaling Transfer Point (STPs) with ILEC STPs. This interconnection provides connectivity that enables the exchange of SS7 messages among ILEC switching systems and databases (DBs), MCIm

local or tandem switching systems, and other third-party switching systems directly connected to the ILEC SS7 network.

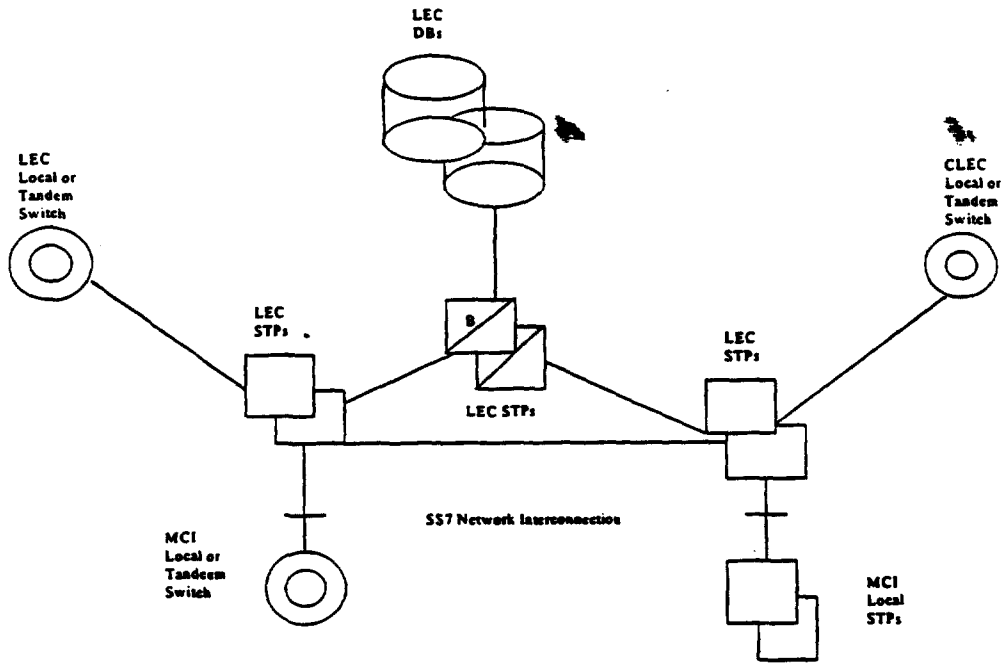

Figure 8. SS7 Network Interconnection

15.5.2 Technical Requirements

15.5.2.1 SS7 Network Interconnection shall provide connectivity to all components of the ILEC SS7 network. These include:

15.5.2.1.1 ILEC local or tandem switching systems;

15.5.2.1.2 ILEC DBs; and

15.5.2.1.3 Other third-party local or tandem switching systems.

15.5.2.2 The connectivity provided by SS7 Network Interconnection shall fully support the functions of ILEC switching systems and DBs and MCIm or other third-party switching systems with A-link access to the ILEC SS7 network.